Space Weather Technical Forecast

Issued on Saturday, 19 February 2022 at 01:02 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1/Minor geomagnetic storm intervals Likely into the new week.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours, with only B-class flares, originating from AR2950 in the northeast quadrant. The B8-flare observed at 18/1623UTC from AR2950 showed evidence of coronal dimming, which may produce a CME, although awaiting further coronagraph imagery for analysis. There are currently four numbered sunspot regions on the visible disc, with one unnumbered sunspot in the northeast quadrant. The majority of the sunspots are small Axx/Bxo Alpha classifications, with the exception of AR2948, which is the largest and most magnetically complex in the southern hemisphere, near centre disc, and is currently classified as a Cso/Beta. No Earth-directed Coronal Mass Ejections (CMEs) were in evidence in available coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, was at background levels, ranging from 320 to 350km/s. The solar wind density displayed a rise from mid-single figures ppcc to peak at 20ppcc at 18/1454UTC. There was also a slight enhancement in ACE EPAM LEMS during the period, which may perhaps indicate a possible transient, with this possibly in course recently at STEREO A according to MAG and PLASTIC data here, although this is conjectural.The IMF rose in magnitude over the same interval, peaking at 11nT during the UTC of Friday evening, before stablising. The north-south component ranged between +8 and -8nT, while the phi angle was negative (towards the sun) throughout. The net result of the above solar wind measures was mostly Quiet, with an Unsettled interval observed 18/1800-2100 UTC, possibly due the aforementioned possible transient (low confidence).

Energetic Particles / Solar Radiation: The high energy proton flux (10MeV) measured at GOES 16 has tracked slightly above background levels since around 12 hours after an evidently very large and energetic flare and CME seen on coronagraph imagery from the rearward eastern solar hemisphere on 15 February. This has plateaued near 1pfu and is unlikely to increase further (in the absence of further such events). The 50MeV and 100MeV traces are unmoved from Background.

The high energy electron flux (greater than 2MeV) was Moderate to High, with a diurnal peak of 4650pfu at 18/1530UTC. The corresponding 24-hour integrated electron fluence plateaued at the start of the period, before rising to above the Active 1e8 threshold, with a peak of 1.06e8 integrated pfu recorded at 19/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low or Very Low at first, given the sparsely populated Earth-facing disc, however there are indications that a large and potent region may rotate onto the facing side into the new working week. The magnitude of this increase will be assessed as and when the spot responsible becomes visible to analyse.

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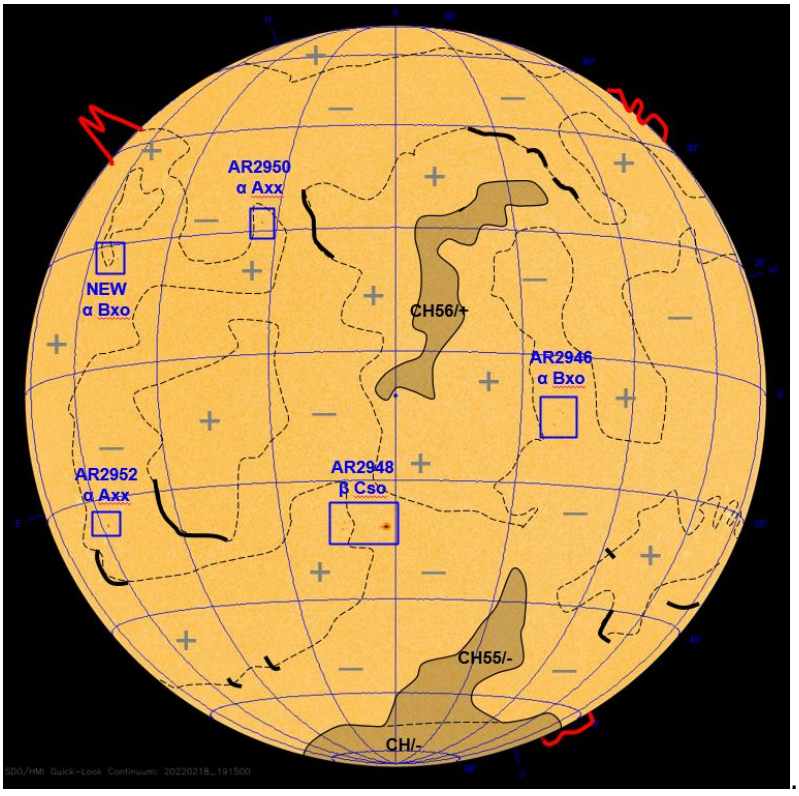
Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast period.

Solar winds should remain in a slow regime until the possible onset of coronal hole 55 and then 56 in succession over the second half of the four-day period. Geomagnetic activity is expected to be Quiet to Unsettled (Kp1-3) during day 1 (Saturday 19th February), with Quiet to Active, and Likely a G1/minor storm interval on day 2 (Sunday 20th February) and possibly into day 3 (Monday 21st February. Quiet to Unsettled, with a Chance of Active intervals on day 4 (Tuesday 22nd February) as solar winds are likely to remain slightly elevated, or elevated, probably reaching 450-500km/s as indicated by the solar wind persistence model.

Energetic Particles / Solar Radiation: The high energy proton flux is expected to remain within Background levels during the period, with the very slightly disturbed 10MeV trace relaxing through the period.

High energy electron flux is expected to reach moderate to high levels on day 1 (Saturday 19th February), decreasing to moderate levels on the remaining days of the period due to onset of high speed stream from coronal holes. The corresponding electron fluence is expected to remain above the Active (>1e8 integrated pfu) electron fluence threshold during day 1 (Saturday 19th February), before reducing due to the onset of fast wind from coronal hole influence. Likely to exceed the Active threshold beyond the current four-day period - once coronal hole geomagnetic activity wanes.

Figure 1. Solar Analysis Valid 18/1915UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No Earth-directed CMEs feature in this forecast at present.

The current background level solar winds are expected to increase over the second half of the UTC weekend and into early next week, due to a high speed stream from a combination of coronal hole influences (CH56 and CH55). These are of opposing polarity, and any transition between them should be distinct. Of the pair, the earlier-arriving ought to be the more impactful, for being of more potent negative polarity (and near the vernal equinox).

After around 24 hours, the phi angle may switch to positive, with effects from CH56/+ probably more muted, although this coronal hole combined with any belated activity from CH55/- should serve to the Likely of a G1/minor storm during day 2 (Sunday 20th February) with a Chance into day 3 (Monday 21st February).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	60	40	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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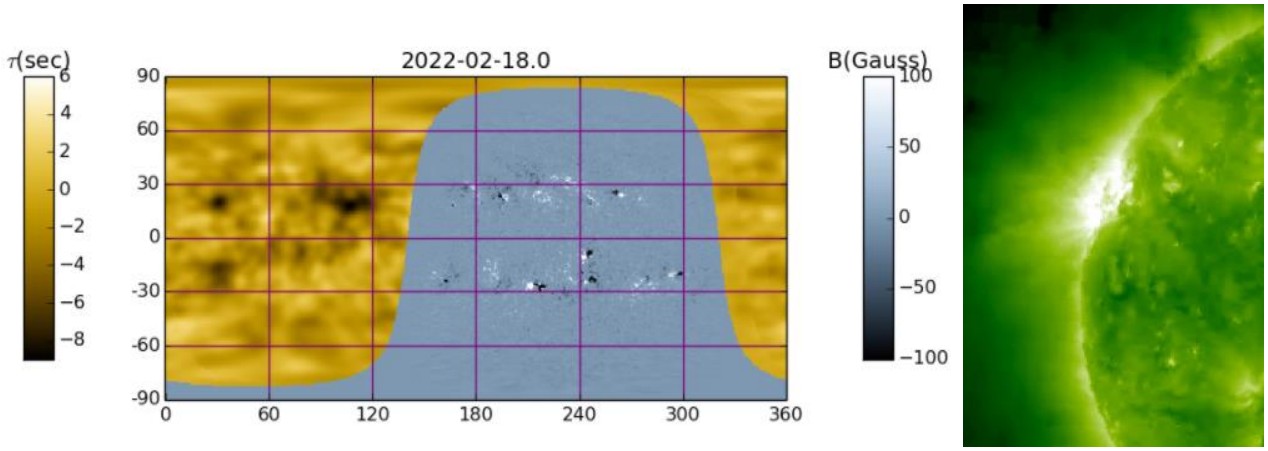
Radio Blackouts - X-Ray Flares:
The solar disc has greatly simplified in the past 24 hours, with the western solar hemisphere seeing all its spots fade, while those in the east remained relatively quiet and unremarkable. Barring any front-sided development, the most significant event likely in the period is the possible return of the region of the sun responsible for the large rearward flare and CME on 15 February, with a fountain of ejecta visible out to half a solar radius in EUVI304. The region responsible may now just be becoming visible on STEREO A EUVI195 imagery, however any upward contribution it makes to the current Slight daily Chance of M-class flares will be assessed when it arrives over the limb. None of the remaining front side spots should leave the disc in the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: Far side soundings of a large region (dark area near 120E) which was probably the source for the explosive far-sided CME seen in coronagraph imagery late on the 15th February. This region now appears on STEREO-A eastern horizon and looks intense, although has been inactive last few days.



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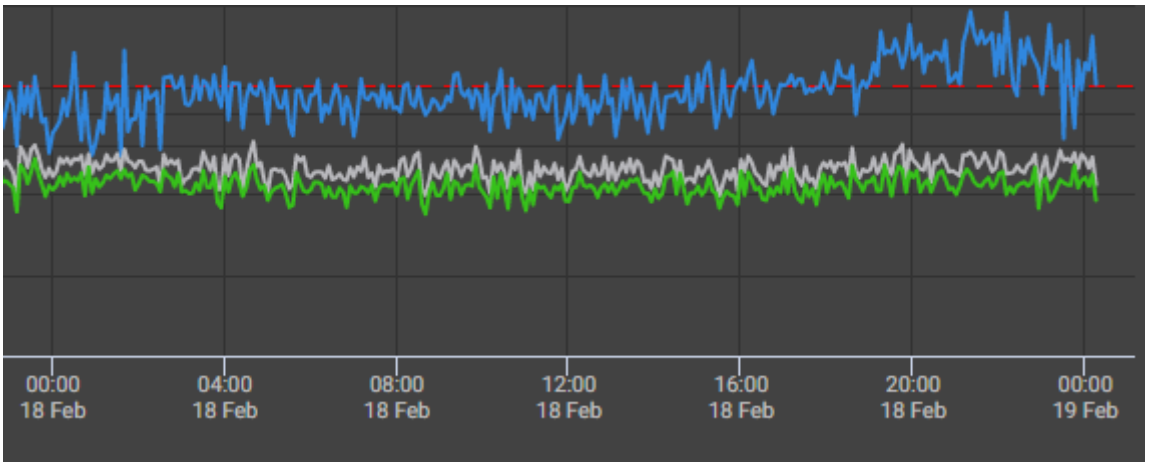
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (10MeV) measured at GOES 16 has tracked slightly above background levels since around 12 hours after an evidently very large and energetic flare and CME seen on coronagraph imagery from the rearward eastern solar hemisphere on 15 February. This region has not produced noteworthy events since, and is moving further from being geoeffective, so while S1 enhancements are not expected, it provides indication of something to watch should it survive into the new week to return to the Earth-facing disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: GOES-16 high energy proton flux for the past 24 hours, showing slightly raised levels, but below threshold, due to lasting effect from the explosive far-sided CME on the 15th February.



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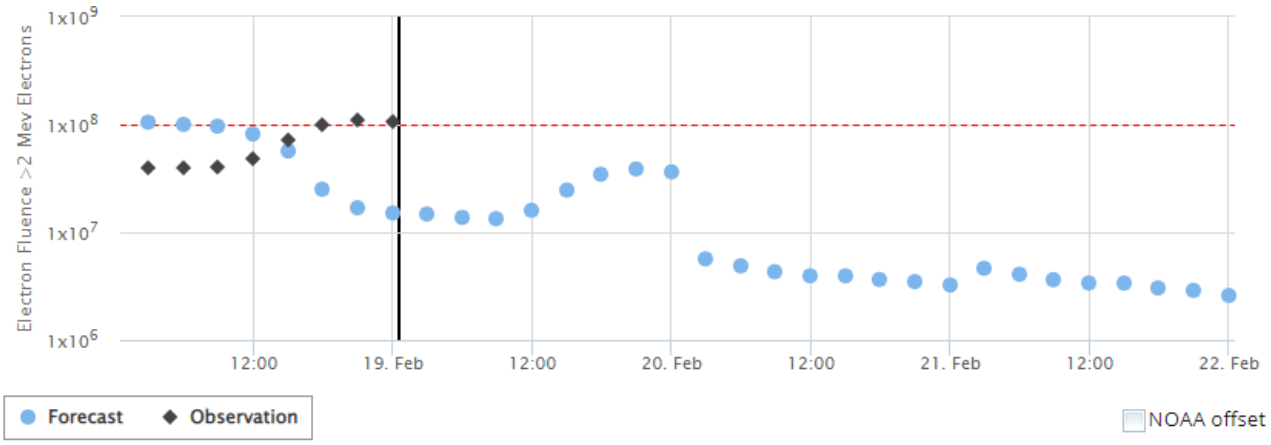
High Energy Electrons Event (≥ 2MeV):

High energy electron flux is expected to follow a similar diurnal trend to that seen at present into the UTC weekend in the absence of any expected external drivers. This is likely to respond upwards in the wake of geomagnetic activity from coronal holes 55 and 56, with much of any rise likely outside of the coming four days.

REFM is currently below expectations, with electron fluence observed to be above the Active threshold, with it Likely to remain so during the UTC weekend. A gradual downward trend is indicated into the new working week, with anticipated arrival of fast wind from coronal holes. REFM is giving a poor guidance in the forecast at present.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	80	60	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: REFM observations and forecast. Currently above the Active threshold, with REFM not offering good guidance at present. Slight downward trend indicated into the new week, with the onset of fast wind from coronal hole influences.



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